

Seungwoong Ha

STATISTICAL PHYSICIST · DATA/NETWORK/ML RESEARCHER

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“Be careful when you judge others,
since everything in this universe is merely a single realization of a stochastic process, not an ensemble average.”

Summary

Applied Complexity Postdoctoral Fellow in SFI (from 23.07.01), studying and reasearching **statistical physics, network science, data science, social science** and **machine learning**. Interested in applying (1) a tool of ML to physics and (2) a tool of physics to every other domain.

Currently working on & interested in -

- Formulating and modelling emergence and evolution of **social phenomena**
- Automatically discovering new **scientific concepts**
- Constructing **collective intelligence** with self-organization and game-theoretical approach

- via modern machine learning techniques, especially with **deep neural networks**.

Education

KAIST (Korea Advanced Institute of Science and Technology)

B.S. IN PHYSICS

Daejeon, S. Korea

Mar. 2013 - Feb. 2017

KAIST (Korea Advanced Institute of Science and Technology)

M.S. & PH.D. IN PHYSICS (INTEGRATED)

Advisor : Hawoong Jeong

Daejeon, S. Korea

Mar. 2017 - Feb. 2023

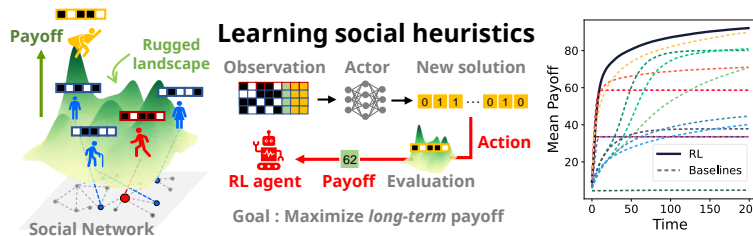
Skills

Programming Java, R, Matlab, Python(Main), Pytorch(ML Main), JAX
Languages Korean (Native), English (B2 ~ C1), Japanese (B1)

Publications

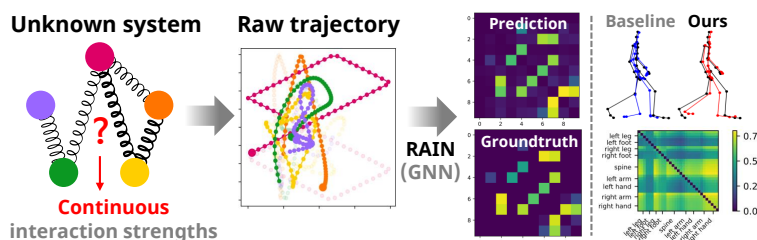
PEER-REVIEWED

2023 **Ha, S., & Jeong, H.** Social learning spontaneously emerges by searching optimal heuristics with deep reinforcement learning. *ICML 2023 (poster)* (📄)



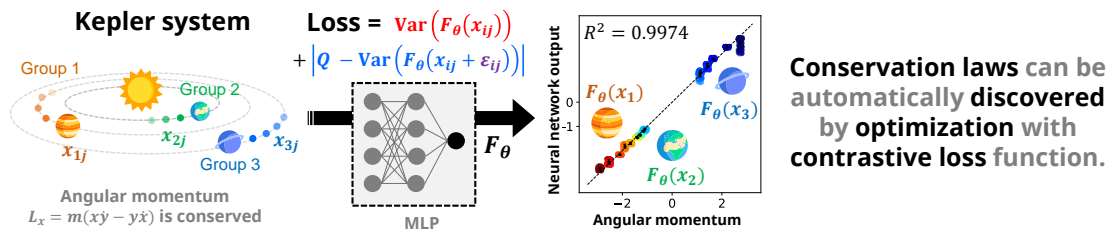
Complex form of social learning strategies naturally emerges from reinforcement learning agents.

2023 **Ha, S., & Jeong, H.** Learning Heterogeneous Interaction Strengths by Trajectory Prediction with Graph Neural Network. *ICLR 2023 (poster)* (📄)

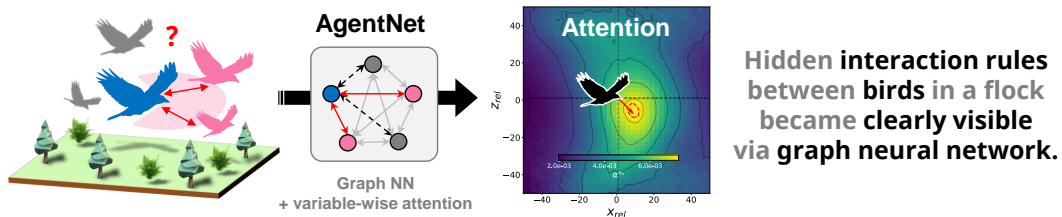


From raw trajectory data, weighted interaction graph can be retrieved via graph attention in an unsupervised manner.

2021 Ha, S., & Jeong, H., Discovering invariants via machine learning. *Physical Review Research* 3(4), L0402035. (📄)



2021 Ha, S., & Jeong, H., Unraveling hidden interactions in complex systems with deep learning. *Scientific reports*, **11**(1), 1-13. (📄)



2016 Ahn, S.†, Ha, S.†, & Kim, S. Y., Optimization strategy for and structural properties of traffic efficiency under bounded information accessibility. *Physica A: Statistical Mechanics and its Applications*, **451**, 578-591. (📄)

IN PREPARATION

2023 Bae, Y., Ha, S., & Jeong, H. Langevin neural networks: learning Langevin dynamics from stochastic trajectories (*working title*)

Presentations

ACADEMIC

- 2023 **ICML 2023**, Honolulu, Hawaii, *Social learning spontaneously emerges by searching optimal heuristics with deep reinforcement learning* (Poster)
- 2023 **ICLR 2023**, Kigali, Rwanda, *Learning Heterogeneous Interaction Strengths by Trajectory Prediction with Graph Neural Network* (Poster)
- 2023 **ADSL workshop** (*Invited*), Soongsil University, Seoul, S. Korea, *Studying social phenomena via modern machine learning* (Oral)
- 2023 **Theoretical Machine Learning workshop** (*Invited*), Seoul National University, Seoul, S. Korea, *AI for the human mind: Studying social phenomena via machine learning* (Oral)
- 2022 **Invited talk**, Northwestern Institute on Complex Systems (NICO), Evanston, IL, *Studying social phenomena via modern machine learning* (Oral)
- 2022 **NeurIPS 2022 Workshop**, New Orleans, LA, *Learning Heterogeneous Interaction Strengths by Trajectory Prediction with Graph Neural Network* (Oral)
- 2022 **Conference on Complex Systems 2022**, Palma de Mallorca, Spain, *Spontaneous emergence of Social learning by searching optimal heuristics via deep reinforcement learning* (Oral)
- 2022 **15th Asia Pacific Physics Conference**, Gyeongju, S. Korea (virtual), *Langevin Neural Network: Inferring Force and Diffusion Fields from Trajectories* (Oral)
- 2022 **2022 Physics and AI Winter school** (*Invited*), The Korean Physical Society, S. Korea (virtual), *Discovering Invariants via Machine Learning* (Lecture)
- 2021 **Quantum intelligence group seminar** (*Invited*), Perimeter institute for Theoretical Physics, Waterloo, Canada (virtual), *Complex system as a playground for deep learning* (Oral)
- 2021 **APCTP Workshop for Physics and Machine Learning**, Ramada Plaza Jeju, Jeju Island, S. Korea (virtual), *Connectivity inference by trajectory prediction with graph attention neural network* (Oral)
- 2021 **Workshop on Artificial Scientific Discovery 2021**, Max Planck Institute for the Science of Light, Erlangen, Germany (virtual), *Discovering invariants via machine learning* (Poster)

- 2021 **2021 The Korean Physical Society Spring Meeting**, S. Korea (virtual), *Discovering conservation laws from trajectories via machine learning* (Oral)
- 2021 **Online seminar (Invited)**, Seoul National University, Seoul, S. Korea (virtual), *Automated interaction discovery in complex systems with machine learning* (Oral)
- 2020 **2020 The Korean Physical Society Spring Meeting**, S. Korea (virtual), *Extracting hidden network from interacting system with graph neural network* (Oral)
- 2020 **NetSci 2020**, Rome, Italy (virtual), *Extracting hidden network from interacting system with graph neural network* (Poster)
- 2020 **Online seminar (Invited)**, Hongkong Baptist University, Kowloon, Canada (virtual), *Deep learning unravels hidden interactions in Complex system* (Oral)
- 2019 **2019 The Korean Physical Society Fall Meeting**, Kimdaejung Convention Center, Gwangju, S. Korea, *Disentangling single agent from Stochastic complex system using Neural Network* (Oral)
- 2019 **2019 The Korean Physical Society Spring Meeting**, Daejeon Convention Center, Daejeon, S. Korea, *Disentangling single agent from complex system using Vertex Attention Neural Network (VAIN)* (Poster)
- 2018 **Korea Academy of Complexity Studies Fall Conference**, Yonsei University, Seoul, S. Korea, *ConservNet : Neural network approach to search invariants from complex systems* (Oral)
- 2018 **The 10th BK21+ Young Physicists Workshop**, Seoul National University, Seoul, S. Korea, *Recovering rules from Simplified Neural Network* (Poster)

GENERAL

- 2021 **Online Seminar (Invited)**, Kakao Corp., S. Korea (virtual), *Unraveling hidden interactions in complex systems with deep learning* (Oral)
- 2020 **Online Seminar (Invited)**, MakinaRocks Co., Ltd, S. Korea (virtual), *Introduction to Graph Neural Network* (Oral)
- 2018 **Seminar (Invited)**, Hyoja High School, Gyeonggi-do, S. Korea, *AI: Neural network and Deep learning* (Oral)

Honors & Awards

INTERNATIONAL

- 2021 **Best research seller**, RHINO 2021 Research Fair

DOMESTIC

- 2021 **Silver Prize**, 27th Samsung Humantech Paper Award, Basic Science division
- 2021 **Excellence Presentation Award**, 2021 The Korean Physical Society Spring meeting
- 2019 **Excellence Presentation Award**, 2019 The Korean Physical Society Fall meeting
- 2019 **Excellence Presentation Award**, The 20st Statistical Physics Workshop
- 2018 **Excellence Paper Award**, 2018 Korea Academy of Complexity Studies Fall Conference
- 2018 **Bronze Prize**, 2018 BK21 Young Physicists Workshop Poster session

Experience

ACADEMIC

Korea Institute For Advanced Study (KIAS)

Seoul, S. Korea

POSTDOCTORAL RESEARCH FELLOW

March. 2023 - June. 2023

- Research fellow at School of Computational Sciences
- Mentored by Deok-Sun Lee (📧)

KAIST

Daejeon, S. Korea

COMPUTATIONAL PHYSICS T. A.

September. 2018 - December. 2018

- Teaching assistant for *Computational Physics*.
- Conducted student practice class with a short lecture and (custom) jupyter notebook practice materials, every Thursday

KAIST

Daejeon, S. Korea

GENERAL PHYSICS T. A.

March. 2017 - December. 2017

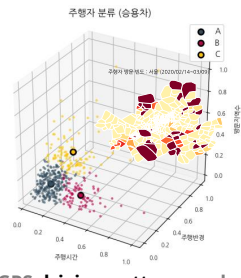
- Teaching assistant for *Advanced Physics 1*, March to June (1st semester).
- Teaching assistant for *General Physics 2*, September to December (2nd semester).

GENERAL

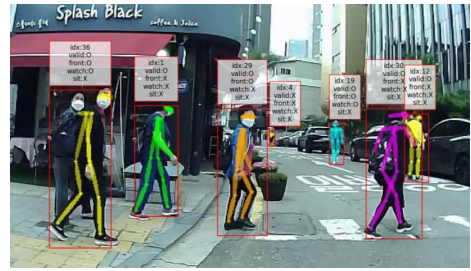
- Analyzing and categorizing driving patterns of app users via GPS trajectories
- Developing an expert system for advertising effectiveness measurement via GPS trajectories from a mobile advertising medium
- Developing AI vision model for pose estimation and advertising effectiveness measurement for mobile vehicles and billboards



Mobile digital outdoor ad + effect measurement



GPS driving pattern analysis



Pedestrian pose & attention estimation